



US005263073A

United States Patent [19]**Feldman**[11] **Patent Number:** **5,263,073**[45] **Date of Patent:** **Nov. 16, 1993****[54] SCANNING SYSTEMS FOR HIGH RESOLUTION E-BEAM AND X-RAY LITHOGRAPHY****[75] Inventor:** Martin Feldman, Baton Rouge, La.**[73] Assignee:** Board of Supervisors of Louisiana State University and Agricultural and Mechanical College, Baton Rouge, La.**[21] Appl. No.:** 811,305**[22] Filed:** Dec. 20, 1991**[51] Int. Cl.⁵** G21K 1/06**[52] U.S. Cl.** 378/34; 378/84;
378/85**[58] Field of Search** 375/34, 35, 84, 85**[56] References Cited****U.S. PATENT DOCUMENTS**

- 4,695,732 9/1987 Ward 250/492.2
 4,705,956 11/1987 Ward 250/492.2
 4,742,234 5/1988 Feldman et al. 250/492.2
 4,891,830 1/1990 Iwahashi 378/34
 4,924,257 5/1990 Jain 355/53
 4,939,373 7/1990 Elliston et al. 250/492.3

- 4,945,551 7/1990 Makabe et al. 378/34
 4,947,413 8/1990 Jewell et al. 378/34
 5,115,456 5/1992 Kimura et al. 378/34

OTHER PUBLICATIONS

Vladimirsky, et al, "High-resolution Fresnel zone plates for soft x-rays," J. Vac. Sci. Technol. B6(1), Jan./Feb. 1988; pp. 311-315.

Ward, et al, "A 1:1 electron stepper," J. Vac. Sci. Technol. B4(1), Jan./Feb. 1986; pp. 89-93.

Kinoshita, et al, "Soft x-ray lithography using multi-layer mirrors," J. Vac. Sci. Technol. B7 (6), Nov./Dec. 1989; pp. 1648-1651.

Primary Examiner—David P. Porta
Attorney, Agent, or Firm—John H. Runnels

[57]**ABSTRACT**

Novel methods and apparatus for high resolution electron beam and X-ray lithography. For electron-beam lithography, a novel 1:1 imaging system is disclosed. For X-ray lithography, novel 1:1 imaging and n:1 reduction imaging systems are disclosed.

14 Claims, 9 Drawing Sheets**X-RAYS**